



Texas Technology 2003 Showcase Plant Steam Trap and Leak Repair Program

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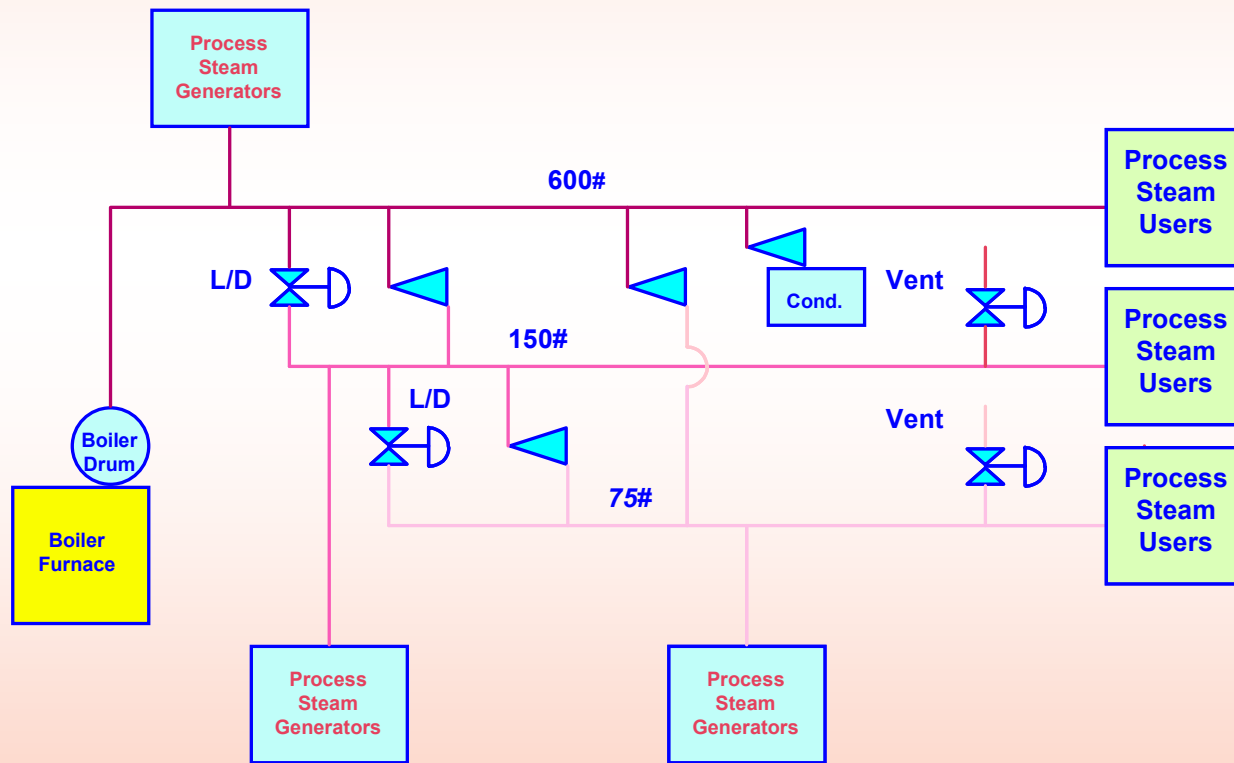


Simplified Plant Steam System

■ Three Main Header Systems

- 600 psig
- 150 psig
- 75 psig

■ Other Local Pressures





Plant Steam System

- ◆ 1,000,000 to 2,000,000 pounds per hour average steam generation.
- ◆ Generation and consumption vary depending on unit rates.
- ◆ Over 20 waste heat boilers – many produce saturated steam.
- ◆ Plant has over 2000 steam traps.
- ◆ Some steam piping over 50 years old.



Audit History

- ◆ Initial Audit performed in March 1999.
- ◆ Losses of over 90,000 pph.
- ◆ Capital Project for \$500,000 implemented.
- ◆ Next Audit in September 2000.
- ◆ Losses down to 44,0000 pph.
- ◆ Partnership with Armstrong and Texas Steam to facilitate repairs.



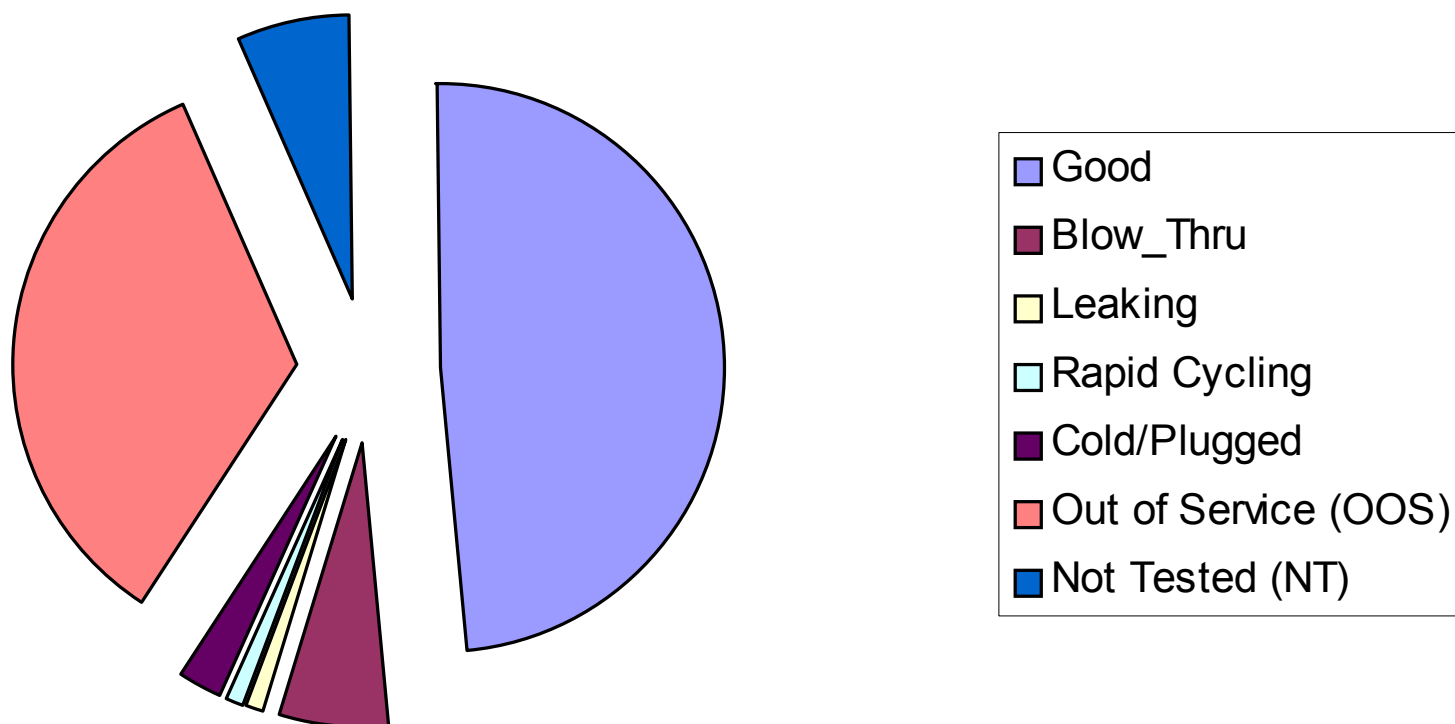
Audit History

- ◆ Most recent Audit on July 2002.
- ◆ Losses down to 28,000 pph.
- ◆ Trapbase 2k software implemented to aid auditing and recordkeeping.



Most Recent Audit Results

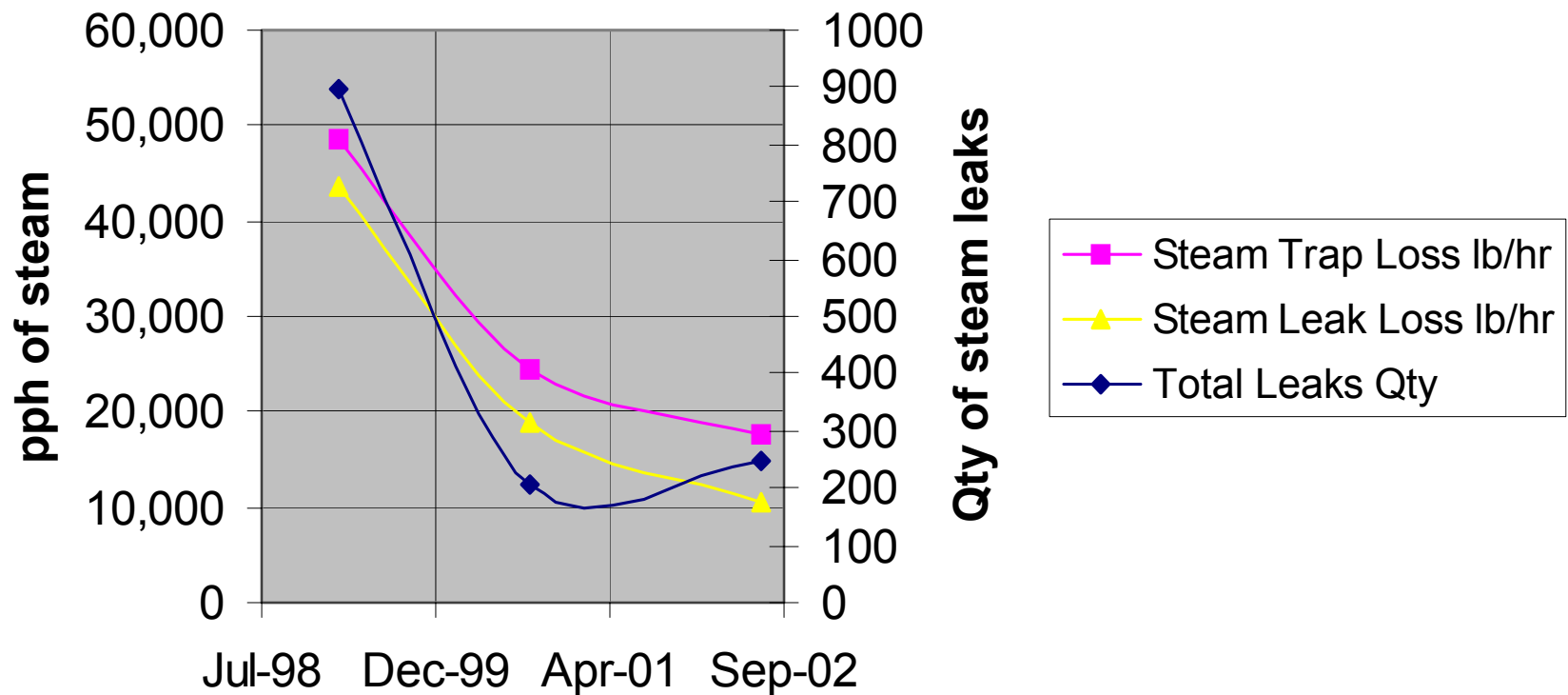
2002 Trap Audit Results





History of Audit Results

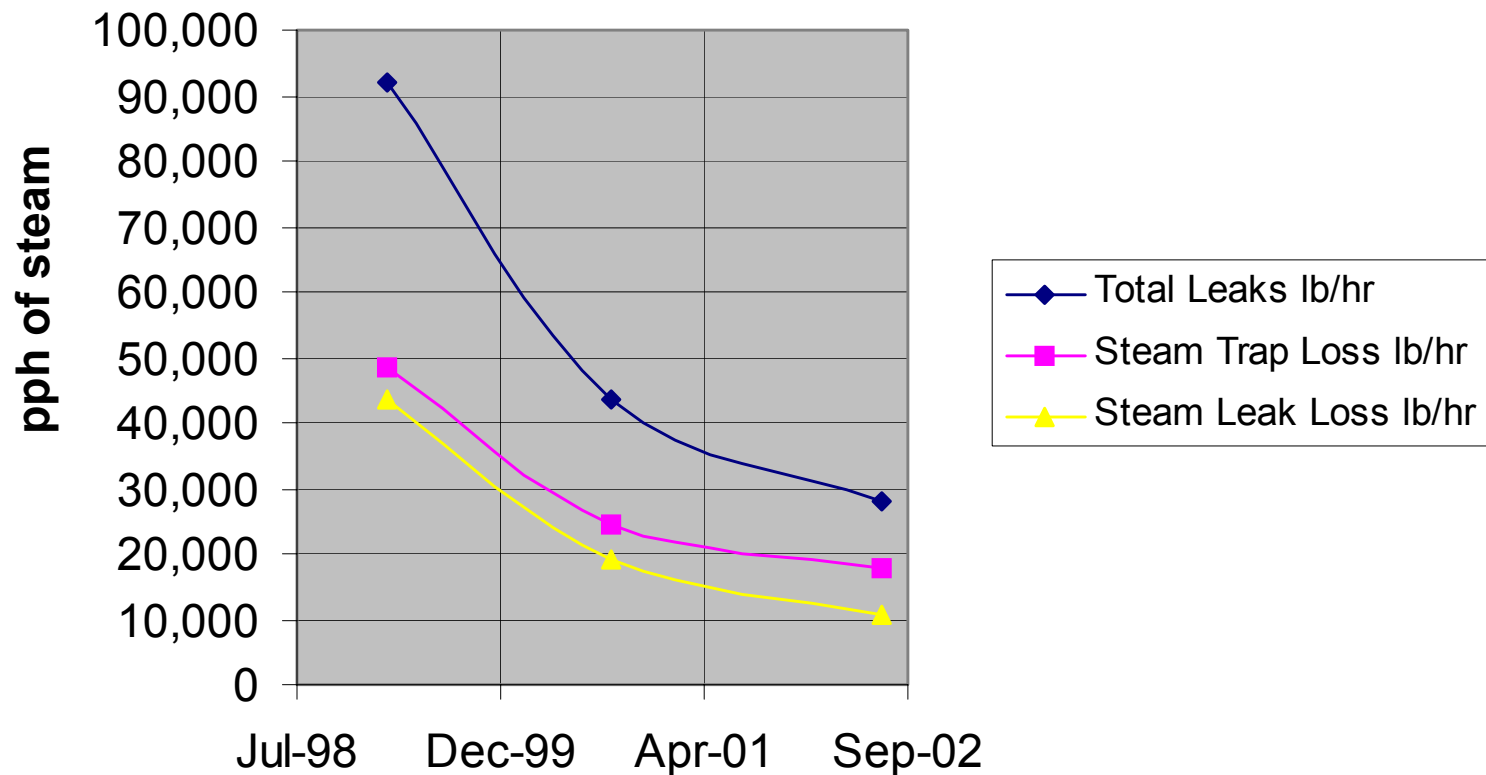
Steam Trap & Leak Audit Results





History of Audit Results

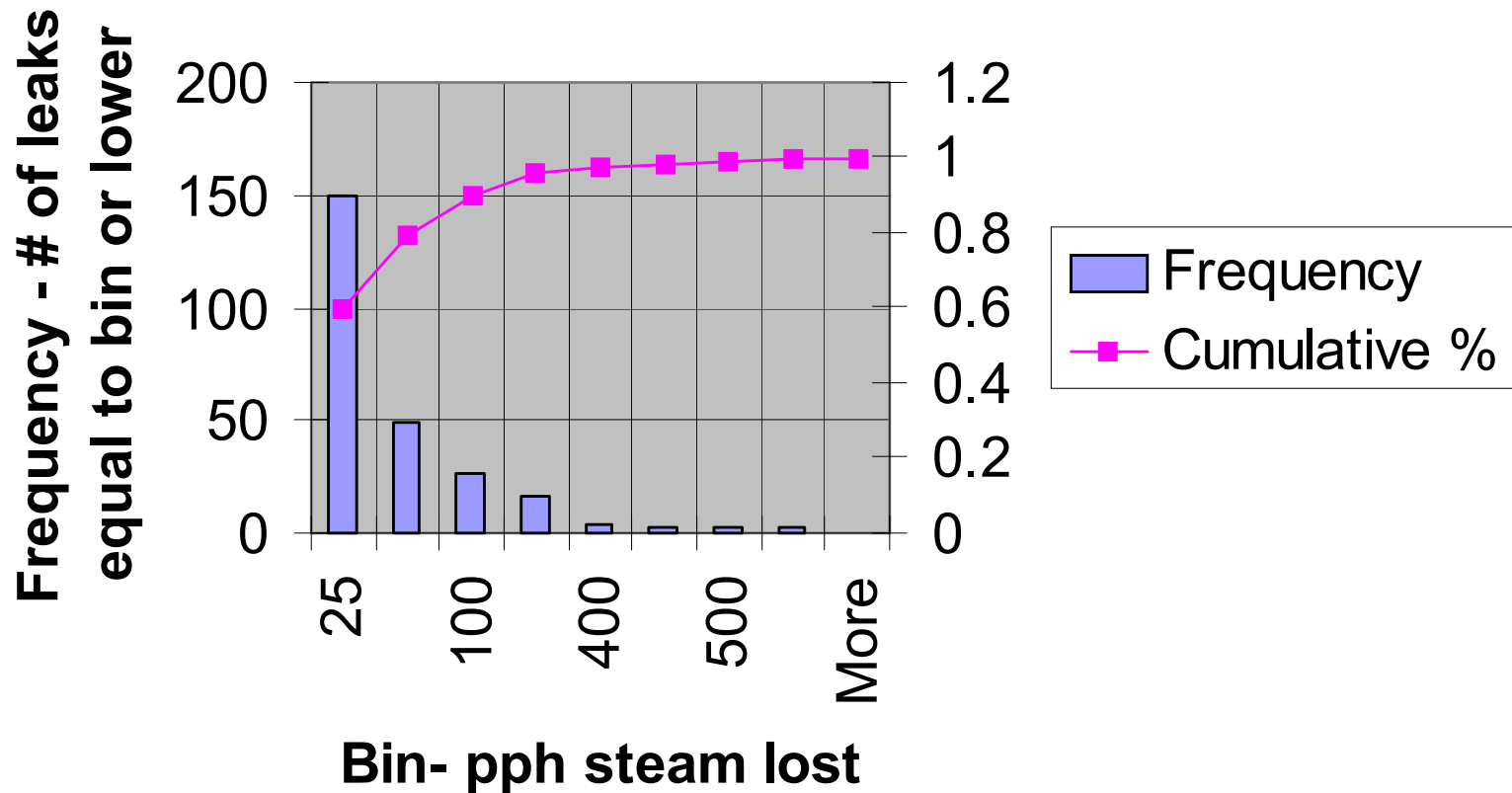
Steam Trap & Leak Audit Results





Leak Size Distribution

Histogram - Steam Leaks Only





Trap & Leak Reliability Data

	Mar-99	Sep-00	Jul-02
Hours between Audits		13176	16104

Failure Rate (no./hr)		0.0321	0.0235
MTBF (hours)		31.1	42.6
Total failures/yr		281	206

Traps only
Traps only
Traps only

Leak Only Failure Rate		0.0157	0.0155
MTBSteamLeak (hours)		63.7	64.4
Projected total leaks/yr		138	136

Leaks Only
Leaks Only
Leaks Only

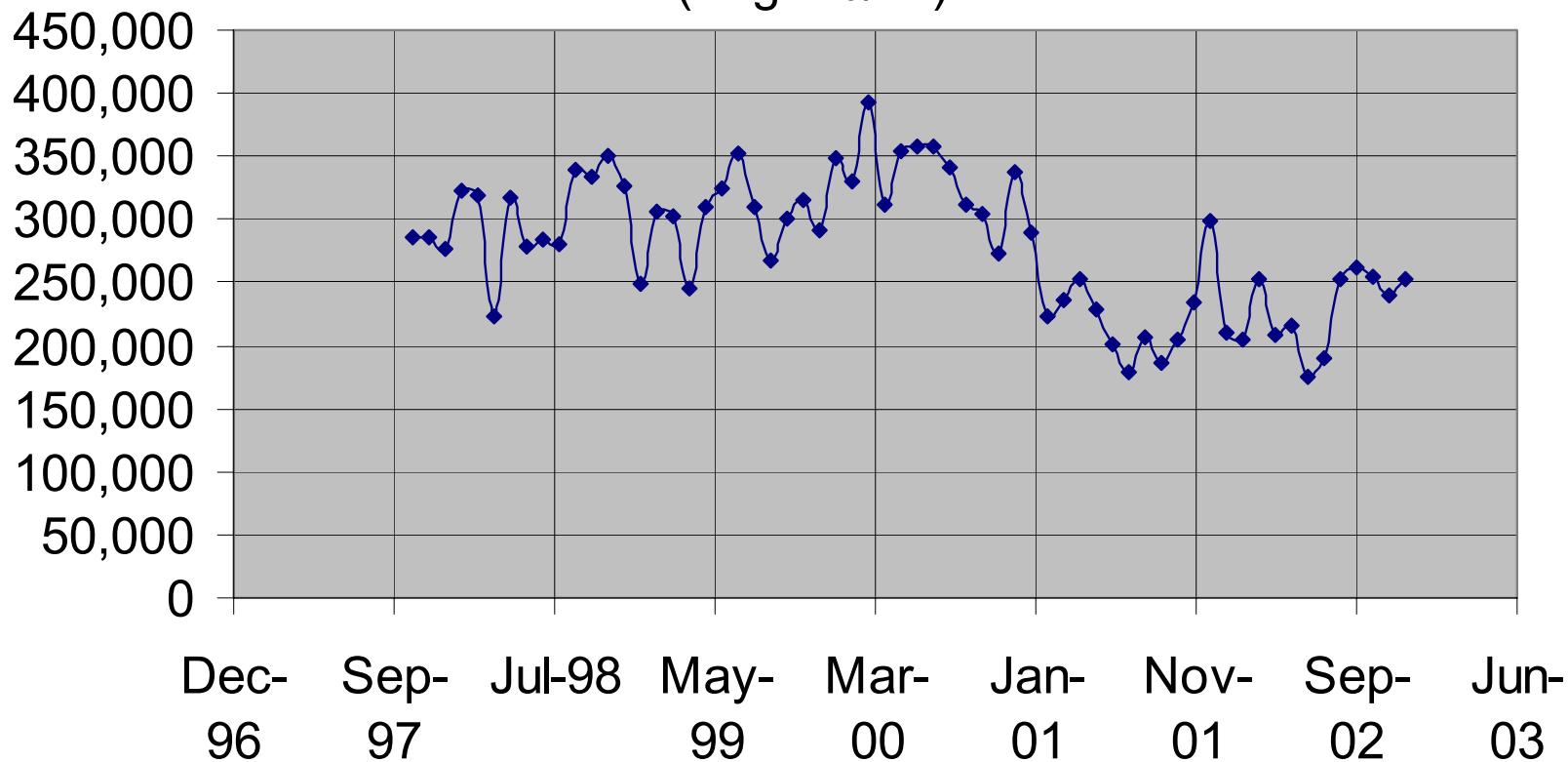
Combined Failure Rate		0.0478	0.0390
MTBF (hours)		20.9	25.6
Projected total failures/yr		419	342

Both
Both
Both



Initial Trap Repairs Begin in Fall 1999

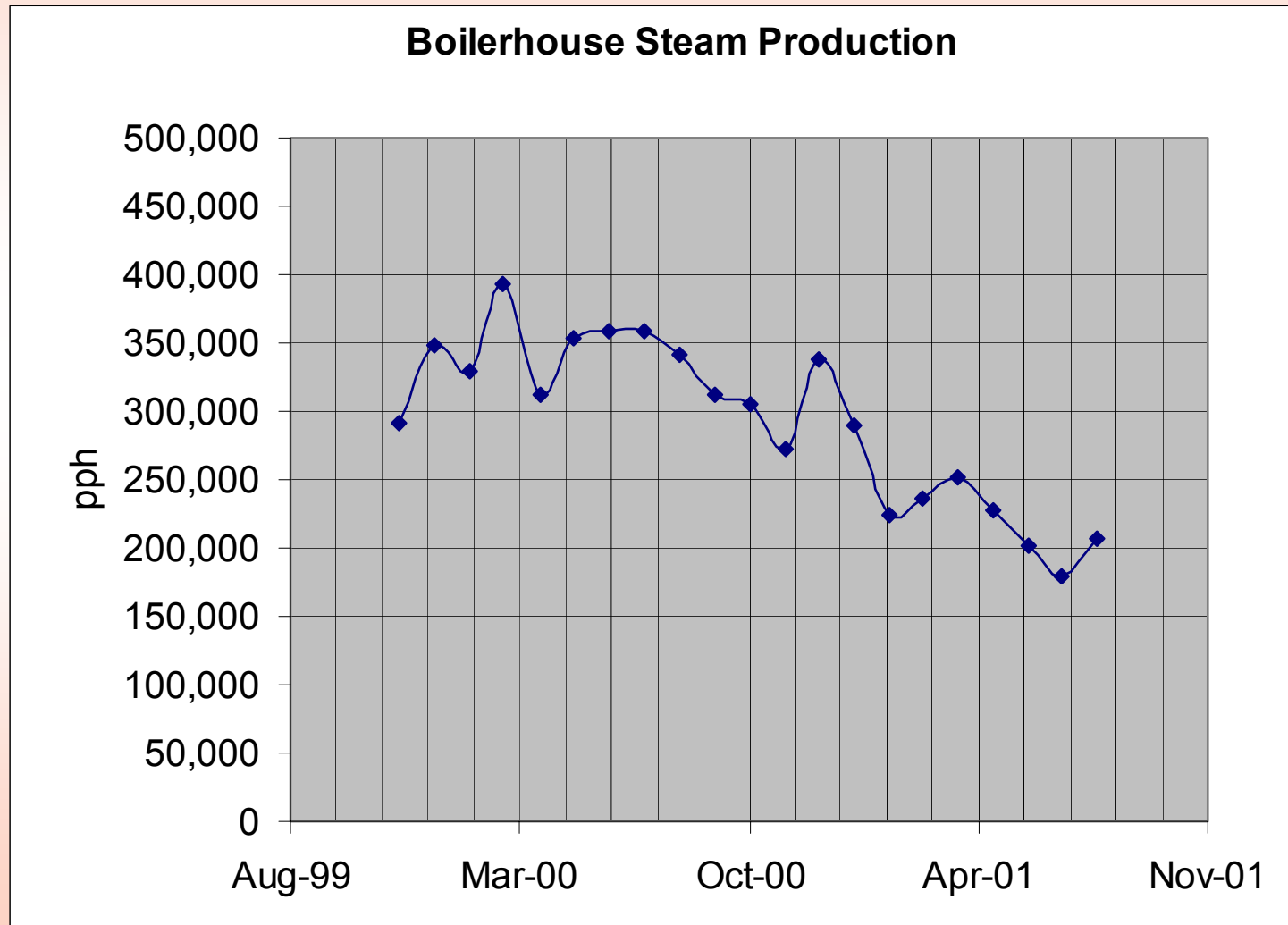
Boiler House Steam Production to Balance Plant
(Avg. Lb/Hr)





Steam Trap & Energy Optimization

Decrease Steam Production





Summary of Learnings

- ◆ Less than half the trap population is working as designed.
- ◆ Each survey finds more traps.
- ◆ Out of service traps comprise 30% of total.
- ◆ We can expect a new leak or trap failure to occur once per day.



Summary of Learnings

- ◆ Bleed valves left open is common.
- ◆ Higher pressure systems have higher failure rates and leak rates although they are a smaller portion of the population.